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## HOW THE EURO CRISIS EVOLVED AND HOW TO AVOID ANOTHER: EMU, FISCAL POLICY AND CREDIT RATINGS

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# ABSTRACT

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This paper argues that the crisis was an outcome of EMU: setting a common monetary policy for countries with different initial inflation rates. The crisis countries were those with high inflation rates which then had negative real interest rates and consequently over-borrowed. Current policy discussions focus on crisis measures: fiscal, banking and political union, not avoiding another crisis. This paper suggests two ways to avoid a future crisis: offset an inappropriate monetary policy using fiscal policy; markets could better price loan rates by taking into account default risk. The paper shows that neither was done prior to the crisis.

JEL Classification: E52, E62, H63 and H68
Keywords: credit ratings, EMU, euro crisis and fiscal policy

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# How the Euro Crisis Evolved and How to Avoid Another: EMU, Fiscal Policy and Credit Ratings*

Vito Polito† and Mike Wickens‡

June 17, 2013

**Abstract**

This paper argues that the crisis was an outcome of EMU: setting a common monetary policy for countries with different initial inflation rates. The crisis countries were those with high inflation rates which then had negative real interest rates and consequently over-borrowed. Current policy discussions focus on crisis measures: fiscal, banking and political union, not avoiding another crisis. This paper suggests two ways to avoid a future crisis: offset an inappropriate monetary policy using fiscal policy; markets could better price loan rates by taking into account default risk. The paper shows that neither was done prior to the crisis.

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## 1 Introduction

The contention of this paper is that the euro crisis originated in the introduction of a single currency which set a common monetary policy for countries with different initial inflation rates. The expectation was that inflation rates would converge making a single monetary policy for all countries viable. The outcome, however, was that countries with the highest inflation rates - which were also the crisis countries - had too low official interest rates, negative real rates, rapid output expansion which fuelled continuing higher inflation, and caused a loss of competitiveness compared with low inflation euro countries. Depending on the crisis country, the negative real interest rates and strong economic activity encouraged excessive private or public borrowing which led to banking and debt crises.

*This paper was presented at the Bank of Greece conference *The Crisis in the Euro Area*, Athens, 23-24 May, 2013.

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The solution proposed by the European Commission (EC) and supported by the European Central Bank (ECB) is to set up a fiscal union, a banking union and a political union together with strict (and common) rules on fiscal deficits and sovereign debts. To many this appears to be a high price to pay to ensure the survival of the monetary union. To some it is a roundabout and dirigiste way of achieving political union. To a large extent, however, these are crisis measures, and are not required in normal times. To avoid a future crisis, and hence to obviate the need for such an intrusive solution, far less drastic solutions may suffice, as explained in this paper.

In this paper we draw upon previous research of the authors on European Monetary Union (EMU), fiscal sustainability and sovereign credit risk (Polito and Wickens (2011, 2012a, 2012b, 2013a, 2013b) and Wickens (2010a, 2010b) where a full set of references may also be found) to explore ways to lessen the likelihood of a future crisis. We consider potential fiscal and market solutions. If monetary policy is inappropriate, a country needs to use its fiscal policy to compensate. This implies that instead of imposing an upper bound on the fiscal deficit that is common to all countries (3% of GDP), it may be necessary to have an even tighter fiscal policy than this to offset a too loose monetary policy for that country.

It is striking that, following the introduction of the single currency, governments were able to borrow at the same short interest rate. As previously noted, this resulted in negative real interest rates for high inflation countries. Even the private sector was able to borrow at negative real rates in most of the crisis countries. This was also in marked contrast to the much higher market rates that prevailed prior to the introduction of the euro. Significantly, a consequence of the financial crisis has been that borrowing rates have returned close to, or above, pre-euro levels due to the market pricing in the risk of default. This suggests that there may be a market solution to the problem of the single currency. Although the ECB is able to set only a single interest rate, the market, by pricing in risk, can set borrowing rates for each country according to their individual economic circumstances. In this way, the market might be able to provide the correct monetary policy for each country. A corollary of this argument is that the euro crisis was less a problem with the euro *per se*, and more a failure of markets to correctly price default risk or, more generally, to take account of financial frictions.

The paper is set out as follows. In Section 2 we present evidence in support of our explanation of how the crisis evolved. In Section 3 we examine the fiscal stances of EU countries in the build up to the crisis how they worsened afterwards due, in large part, to the decline of GDP. In particular, we consider the extent to which the fiscal stance offset monetary policy. In Section 4 we suggest a new way to evaluate the fiscal stance. This is based on a country's credit rating. Rather than use official credit ratings, which during the crisis have often appeared to be inappropriate, we use our own estimates of sovereign credit ratings which are based on explicit fiscal fundamentals. These credit ratings may be linked to credit spreads and to default swap rates which indicate how markets should adjust borrowing rates above the official interest rate and

thereby apply a correction to official monetary policy appropriate for individual country circumstances.

## 2 The role of EMU in the crisis

It is widely accepted that the euro zone was not an optimal currency area prior to its inception. Of particular significance was the difference in member-countries inflation rates. It was thought that these would converge over time but having a single monetary policy based, in effect, on low German inflation rates prevented this. The consequence was that countries with the highest inflation rates - what turned out in 2008 to be the crisis countries: Greece, Ireland, Italy, Portugal and Spain - suddenly had negative real interest rates. As a result, borrowing increased dramatically. In the case of Greece and Italy this was public borrowing; in the case of Ireland, Portugal and Spain it was private borrowing, mainly for real estate. The consequence was that economic activity in the crisis countries was strongly stimulated, inflationary pressures mounted instead of lessened and competitiveness was lost. Meanwhile, given its remit, the ECB was powerless to do anything about this. Indeed, to judge by ECB publications and speeches, the problem seems not even to have been perceived despite being a logical consequence of the New Keynesian model that underpinned ECB monetary policy, see Wickens(2012, ch 14).

The evolution of national price and output levels before the crisis strongly supports this argument. Selected country price level increases are shown in Figure 1. As predicted, the crisis countries have much greater increases than Germany. After the crisis price levels flatten out in all countries.

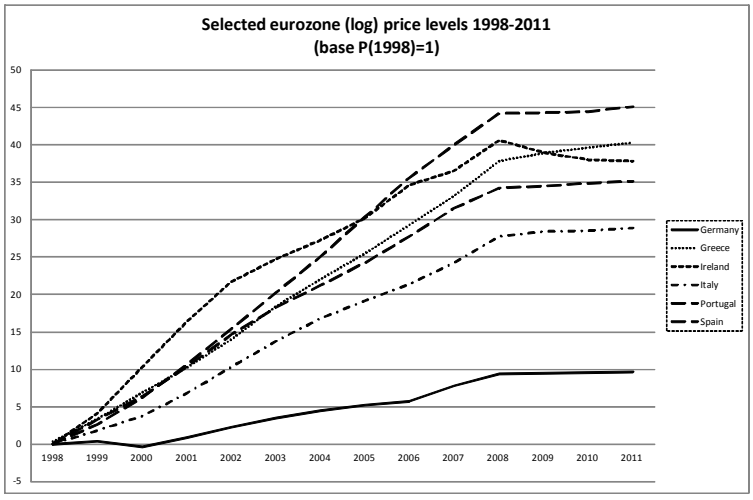


Figure 1

The effect of the initial conditions prior to the inception of the euro are reflected in Figure 2 in which we plot the average rate of inflation prior to the

crisis against their initial rate of inflation in 1999 for all euro countries. There is a very strong positive relation between the two. This provides no support for the convergence of inflation rates; on the contrary, they appear to diverge further.

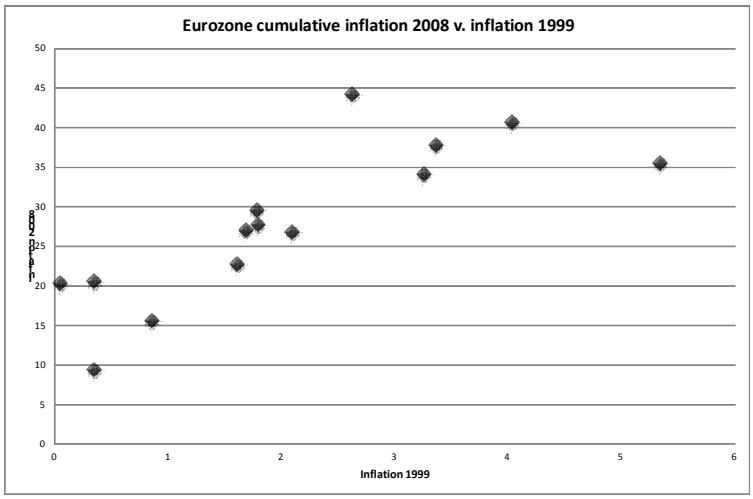


Figure 2

Cumulative output growth for selected countries is shown in Figure 3. The growth of output in Greece, Ireland and Spain is much stronger than that of Germany. After the crisis output growth is strongly affected by the crisis in these three countries.

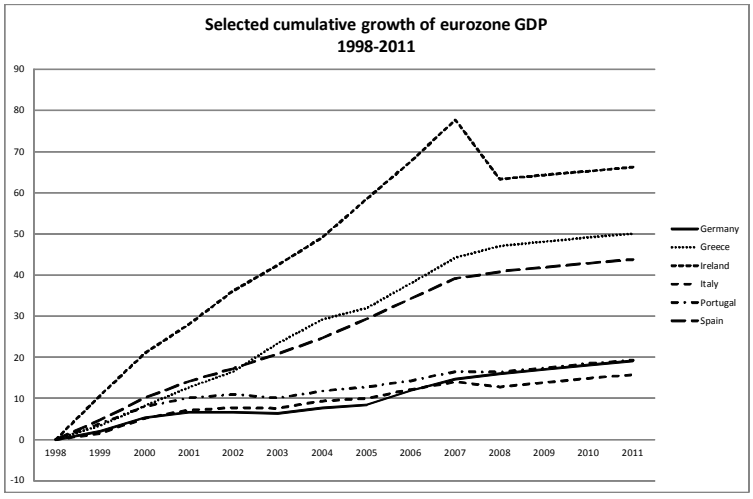


Figure 3

In Figure 4 we show that prior to the crisis cumulative output growth and price level increases have a strong positive relation for all euro countries. Again,

as predicted, in Greece prices increased by 38% and output by 47%, the corresponding numbers for Ireland are 41% and 63%, and for Spain are 44% and 41% while those for Germany are 9% and 16%. Thus, comparing the price levels, Greece lost 29% of its competitiveness against Germany, Ireland 32% and Spain 35%. Not surprisingly these countries experienced growing current account deficits.

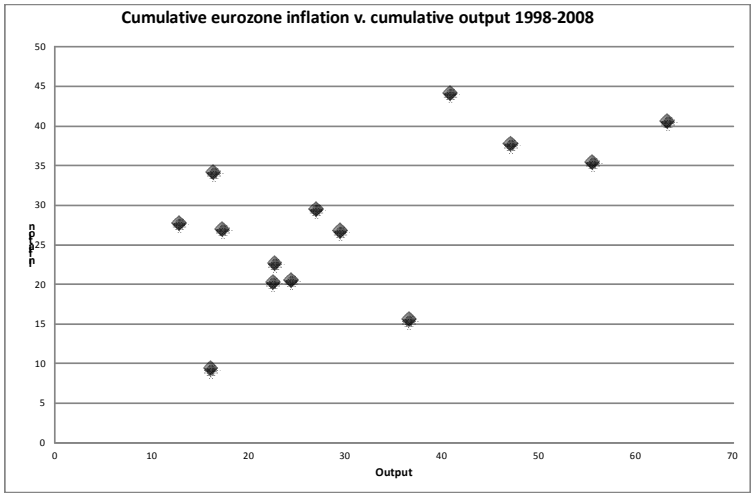


Figure 4

The effect of inflation on real interest rates (the official rate minus inflation) is shown in Figure 5. Prior to the crisis real interest rates were largely negative in the crisis countries. After the crisis they peaked in all countries in 2008. In Ireland where they rose to 7 per cent. They also rose sharply in Spain but did not exceed 2 per cent. Throughout the whole period Germany had positive real interest rates. The relation between real interest rates and output may be inferred from Figure 5 by inverting the vertical axis, implying that the lower the real interest rate, the greater is output growth.

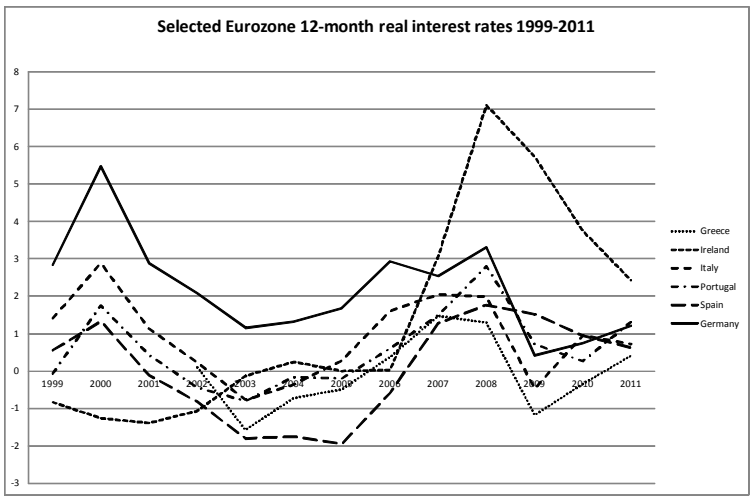


Figure 5

Taken together this evidence provides strong support for the argument that EMU, with its one-size-fits-all monetary policy, is likely to have been a major contributor to the crisis due to causing in the crisis countries low real interest rates which encouraged borrowing and led to strong but unsustainable economic growth, a failure of inflation rates to converge, a loss of competitiveness and current account deficits.

If the ECB is powerless to set a monetary policy stance that is appropriate for all eurozone countries then for EMU to be sustainable there needs to be an offsetting effect. In principle, fiscal policy could be used to achieve this; having given up ones monetary policy one would then have to use fiscal policy to compensate. Later we consider whether there might also be a market-based solution. First, we consider the fiscal stance of EU countries in recent years.

# 3 The Fiscal Stance of EU Countries

The fiscal stance of EU countries plus the US is shown in Figure 6 which reports government expenditures, revenues and debt 1999-2012. It is clear that there was a deterioration in the fiscal stance of most countries from 2008. This was largely due to rising expenditures as a proportion of GDP, while tax revenues, although falling in absolute terms, were fairly constant as a proportion of GDP. The common factor in this is the fall in GDP as expenditures stayed roughly constant but revenues fell with the fall in GDP.

It is also clear that from the start of EMU none of the crisis countries adopted a tight fiscal stance in order to offset the expansionary effects of monetary policy. Even prior to the crisis, however, in Greece, Italy and Portugal expenditures exceeded revenues. In Ireland the budget was close to balance, and in Spain revenues exceeded expenditures causing debt to fall, implying that in neither country was the crisis due to excessive government borrowing, but excessive

private borrowing. Nonetheless, fiscal policy was not used, or sufficient, to offset this. Perhaps one reason why the fiscal positions of many of the crisis countries was not a concern prior to the crisis was that strong GDP growth boosted tax revenues.

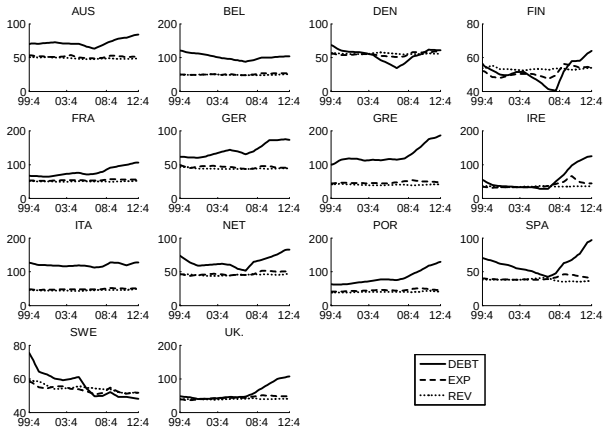


Figure 6. Fiscal data for EU countries 1999-2012

A related question is whether the fiscal stance in eurozone countries can be measured and monitored in a meaningful way. Econometric analyses of fiscal policy sustainability are based on the assumption the government budget constraint (GBC) must hold in present value terms over the infinite horizon. This imposes weak restrictions on future fiscal policy, but does not provide any relevant policy prescription. Polito and Wickens (2011, 2012a) have suggested an index of the fiscal stance which addresses this question. Unlike the standard econometric tests of fiscal sustainability, the index is suitable for assessing fiscal policy in the short and medium term as it can measure whether a government is under- or over-borrowing relative to a pre-specified debt target. It can also quantify the required fiscal consolidation needed to achieve that target at any future time horizon.

The index is derived from the (GBC) as a proportion of GDP:

$$\begin{aligned} \frac{b_t}{y_t} &= (1+\rho_t)\frac{b_{t-1}}{y_{t-1}} + \frac{d_t}{y_t} \\ \frac{d_t}{y_t} &= \frac{g_t}{y_t} + \frac{z_t}{y_t} - \frac{v_t}{y_t} \end{aligned} \tag{1}$$

where $d_t$ is the primary deficit inclusive of seigniorage revenue, $g_t$ is government expenditures, $z_t$ are transfers, $v_t$ are tax revenues including seigniorage revenues, $b_t$ is debt, $y_t$ is GDP and

$$\rho_t = \frac{1+R_t}{(1+\pi_t)(1+\gamma_t)} - 1$$

is the real interest rate adjusted for economic growth, with $R_t$, $\gamma_t$ and $\pi_t$ denoting the nominal interest rate on debt, the rate of growth of GDP and the inflation rate respectively.

The index of the fiscal stance in a specific period $t$ measuring the fiscal adjustment over the time horizon $n$, $FSI\,(t,n)$, is derived from a log-linear approximation about its steady-state value of the n-period ahead solution to the GBC, equation (1). It can be written as

$$\begin{aligned} FSI(t,n) &= \frac{(1+\rho)^{-n}\ln(\frac{b_{t+n}}{y_{t+n}})^*}{(b_t/y_t)\exp[\sum_{s=1}^{n}(1+\rho)^{-s}E_t(k_{t+s})]} \\ k_t &= c+\frac{g}{b}\ln\frac{g_t}{y_t}+\frac{z}{b}\ln\frac{z_t}{y_t}-\frac{v}{b}\ln\frac{v_t}{y_t}+(1+\rho)\ln(1+\rho_t) \end{aligned}$$

where variables without a $t$ subscript denote steady-state values, $\ln(\frac{b_{t+n}}{y_{t+n}})^*$ is the debt-GDP target to be achieved by period $t+n$ and $E_t k_{t+s}$ denoting the expectation based on information available in $t$ of the logarithmic equivalent of the future primary deficit, see Polito and Wickens (2012a) for details. The index therefore measures in period $t$ the ratio of the desired level of the discounted debt-GDP ratio in period $t+n$ to its forecast value. A value of the index equal to, above or below 1 implies that the forecast debt-GDP ratio for period $t+n$ is on, above or below target, respectively. In the latter case, the level of discounted debt-GDP ratio is forecasted to be above its desired value, suggesting that fiscal policy is too loose. Only as $n \to \infty$ does the index provide a measure of fiscal sustainability in the same sense as the econometric tests, namely, whether the government budget constraint holds in present value terms over the infinite horizon.

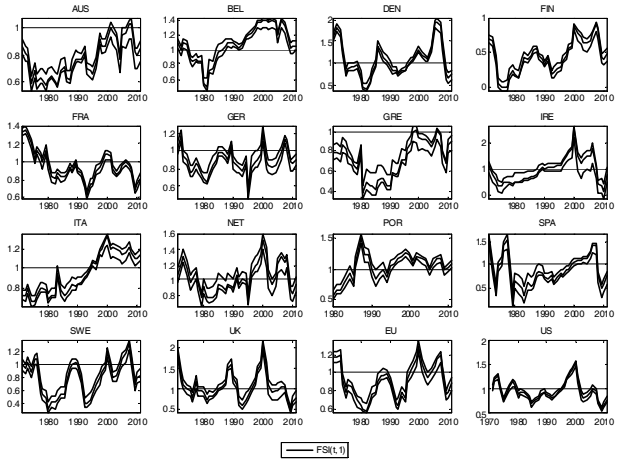


Figure 7. Index of the fiscal stance for EU countries

The index is plotted for eurozone countries in Figure 7 from 1979-2011 together with 95% confidence bands under the assumption that fiscal policy aims

to keep the debt-GDP ratio constant over a 1-year ahead horizon (i.e. $n = 1$). It is clear from the variability of the index that the fiscal stance is not constant through time. All countries show a decline in the ability of governments to meet their debt obligations following the crisis in 2008, reflecting the loss of output mentioned above. Of the crisis countries, Greece, Ireland and Spain show the greatest fiscal deterioration. Prior to the crisis Italy, Ireland, Portugal and Spain had viable fiscal stances, but Greece did not. More importantly, the fiscal policy adjustments vary over time and from country to country. Achieving the same fiscal deficit as non-crisis countries - as is being proposed - is not sufficient for the crisis countries. What is required is a country-specific fiscal policy that offsets the expansionary effects of monetary policy.

One possible response is either to reduce expenditures or to raise tax rates. The IMF (2009a, 2009b) has proposed an ad hoc rule in which 2/3 of the adjustment should be by reducing expenditures (including transfers) and 1/3 should be by raising tax revenues, see Cottarelli and Viñals (2009). In Polito and Wickens (2012a) we estimate the average annual adjustment in the budget deficit (%GDP) required to restore the debt-GDP ratio to the pre-crisis 2007 level by 2016 and 2030, based on data up to 2011. Bringing the debt-GDP ratio back to its 2007 level is regarded by the IMF as not only a reasonable goal, but a minimum requirement of any viable strategy for restoring a normal fiscal stance, see Cottarelli and Viñals (2009). The results for the crisis countries are reported in Table 1. Not only do fiscal consolidation plans vary from country to country, they also depend on the required timing of the fiscal adjustment. Clearly longer time horizons make fiscal adjustments more feasible to achieve.

Table1
Average annual tax increases required to restore
the 2007 debt-GDP ratio by 2016 and 2030.

| | Greece | Ireland | Italy | Portugal | Spain |
|---|---|---|---|---|---|
| 2016 | 6.6 | 11.3 | 3.3 | 3.2 | 3.3 |
| 2030 | 1.4 | 1.8 | 0.7 | 0.9 | 0.5 |

# 4 The Market's View: Interest Rates and Credit Ratings

## 4.1 Interest rates

If fiscal policy did not offset monetary policy in countries where it was inappropriate, did the market do so? As noted, prior to EMU most of the crisis countries faced much higher borrowing costs than they did afterwards as governments could borrow close to the official ECB interest rate before 2008 and the private sector interest rates were similarly low. In principle, there is no reason why markets shouldn't adjust rates to reflect the risk of default. After the crisis this is precisely what they did, but they failed to do so before. Bond risk premia are usually the result of inflation or interest rate risk rather than

default risk, but when bonds are priced in the same currency, and with the same official interest rate, this sort of risk no longer distinguishes the prices of bonds of individual countries.

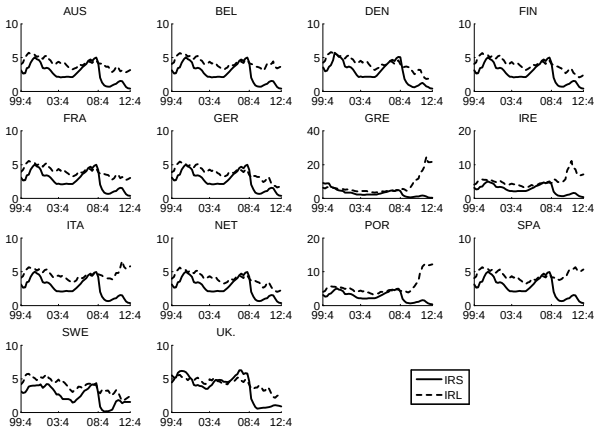


Figure 8. Short and long interest rates for EU countries 1999-2012

Short-term (3-month) and long-term (10-year) interest rates for EU countries from 1999-2012 are shown in Figure 8. It is clear that prior to the crisis there is little difference in the rates charged to eurozone countries. After the crisis long rates rose sharply in Greece, Italy, Ireland, Portugal and Spain, but not in non-crisis countries. It would therefore appear that prior to the crisis markets did not price in default risk and so did not act to offset the official rates set by the ECB, though they did so after once the crisis occurred.

## 4.2 Credit Ratings

Sovereign credit ratings provide an alternative measure of the market's assessment of default, and hence they could indicate to markets what interest rates to charge. As can be seen in Figure 10 below, with the exception of Greece, all the crisis countries received an investment grade rating and only after the crisis - usually some time after the crisis - were their ratings reduced close to (or to) speculative grade. It would therefore appear that market-based credit ratings did not anticipate the crisis either, rather they were even late in registering the crisis. The three main credit rating agencies (Fitch, Moody's and S&P) have been criticised for their failure to react quickly to the crisis. This applies equally to the credit ratings for the United States and the United Kingdom as to eurozone countries and prompted Polito and Wickens (2012b, 2013a and 2013b) to explore the possibility of constructing sovereign credit ratings in a different way based on readily available fiscal data. An advantage of this approach over the fiscal stance index reported above is that it doesn't require an arbitrary debt-GDP target, yet processes the same information.

The idea is to forecast the probability that the debt-GDP ratio over a given horizon is likely to exceed the maximum debt-GDP ratio that a country can repay. This probability is then mapped into a credit rating using historical records on credit ratings and default probabilities that was provided by Moody's. The forecasts are based on evaluating the intertemporal government budget constraint whose components are derived from a rolling-window VAR with time-varying volatility. This implies that not just the point forecast of the debt-GDP ratio but also its distribution may change over time thereby reflecting structural change, perhaps due to policy. The debt-GDP threshold is obtained from an open-economy real business-cycle model with distortionary taxation. The threshold can be based either on anticipated future changes in tax policy, or on the maximum revenues that can be generated if unanticipated changes in future tax rates were to occur. The resulting debt-GDP values are referred to as the intertemporal government budget constraint limit (IGBCL) and the fiscal limit (FL), respectively. The concept of a fiscal limit was first introduced by Davig, Leeper and Walker (2011). Both the tax rates and the debt-GDP threshold are calibrated to each economy and vary over time. The thresholds fall after the crisis due to rising interest rates and so lower the credit rating. Full details are given in Polito and Wickens (2013b). Here we provide a brief description.

The debt-GDP ratio is forecast using the solution to the GBC compounded $n-$periods ahead, equation (1),

$$\frac{b_{t+n}}{y_{t+n}} = -E_t \sum_{j=1}^{n} \left[ \Pi_{s=1}^{j} \left(1+\rho_{t+s}\right) \frac{d_{t+j}}{y_{t+j}} \right] + \Pi_{s=1}^{n} \left(1+\rho_{t+s}\right) \frac{b_t}{y_t}.$$

The cumulative probability of defaulting within the $n$-period horizon is

$$p^d_{t,t+n} = \Sigma_{j=1}^{n} p_{t,t+j}$$

where

$$\begin{aligned} p_{t,t+n} &= p_{t+n}\left(1-p_{t+n-1}\right)\left(1-p_{t+n-2}\right)...\left(1-p_{t+1}\right) \\ p_{t+n} &= \Pr\left(\frac{b_{t+n}}{y_{t+n}} \geq \overline{\frac{b_{t+n}}{y_{t+n}}} | \frac{b_t}{y_t}\right) \end{aligned}$$

$p_{t,t+h}$ is the probability of sovereign default by period $t+n$, $p_{t+n}$ is the probability of default in period $t+n$ and $\overline{\frac{b_{t+n}}{y_{t+n}}}$ is the default threshold (debt-GDP limit).

The IGBCL derived from anticipated future expenditures and revenues, which are based on existing policy, is

$$\frac{b_t}{y_t}^{IGBCL} = -E_t \sum_{j=1}^{\infty} \frac{\frac{g_{t+j}}{y_{t+j}} + \frac{z_{t+j}}{y_{t+j}} - \frac{v_{t+j}}{y_{t+j}}}{\prod_{s=1}^{j} \left(1+\rho_{t+s}\right)}. \tag{2}$$

The FL, based on the same expenditures, but now maximizing revenue from labour and capital taxes is

$$\frac{b_t}{y_t}^{FL} = E_t \sum_{j=1}^{\infty} \frac{\frac{g_{t+j}}{y_{t+j}} + \frac{z_{t+j}}{y_{t+j}} - \frac{v_{t+j}^{\max}}{y_{t+j}}}{\prod_{s=1}^{j} \left(1 + \rho_{t+s}\right)}, \tag{3}$$

where $\frac{v_{t+j}^{\max}}{y_{t+j}}$ is the maximum tax revenue, see Polito and Wickens (2013). The empricial computation is based on the stationary equilibrium solutions of the two debt limits in equations (2) and (3).

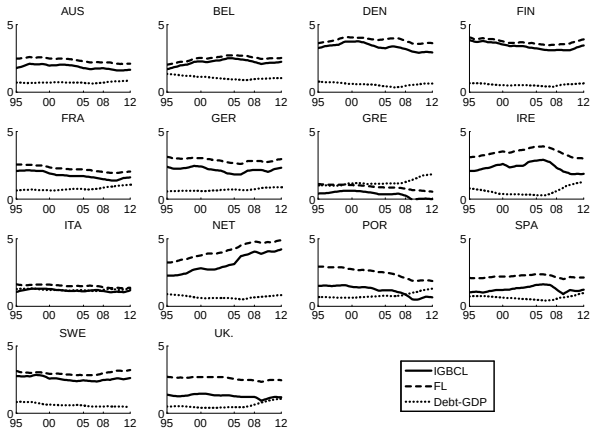


Figure 9. Debt-GDP limits for EU countries

In Figure 9 we show the IGBCL, the FL and the current debt-GDP ratio over the period 1995-2012. We observe that both debt limits vary over time; usually then get tighter after 2008. For all countries FL lies above IGBCL, implying that there is room to raise more tax revenues. But the gap is very small for many countries (Austria, Belgium, Denmark, Finland, France, Greece, Italy and Sweden). This suggests that there is greater scope in these countries for raising their borrowing capacity by reducing expenditures than by increasing taxes. For all countries except Greece and, after 2008, Italy and Portugal, the actual debt-GDP ratio lies below the IGBCL. This implies that for these countries the present value of expected discounted future primary surpluses was large enough to finance the current level of debt. For Greece this was not the case for the whole period, and the gap widened considerably from 2007. For Italy and Portugal this doesn't hold from 2008, while for Ireland and Spain the gap closes markedly after 2008. Once again, therefore, the evidence points to a failure to tighten fiscal policy in the crisis countries prior to 2008, and to a worsening of the fiscal stance from 2008.

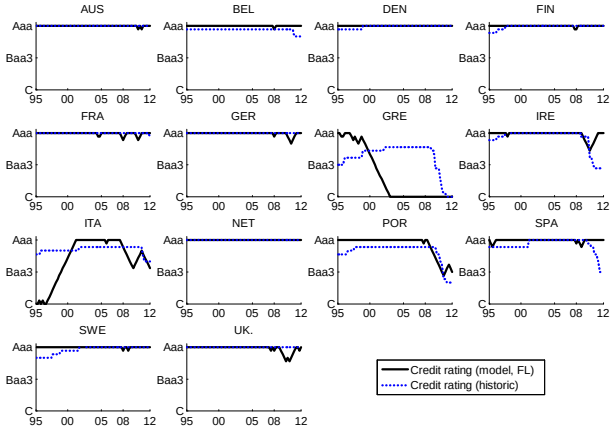


Figure 10. Historic and model-based credit ratings for EU countries

In Figure 10 we report our measure of the credit ratings for a five-year horizon based on FL together with the official historic ratings over the period 1995-2012. The solid line is the new credit rating estimate. While the two ratings are similar for non-crisis countries, they differ for the crisis countries. Although the official credit rating for Greece is several notches below triple-A throughout, our measure of the credit rating is speculative grade from roughly the point at which Greece joined EMU in 2002. Our measure also indicates an earlier downgrade than the official ratings for all of the other crisis countries. This suggests that the rating agencies appear to have reacted too slowly to the crisis and that a better processing of available fiscal data may have prevented this.

Another interesting finding is that after the crisis the official ratings for Ireland and Spain are well below our measure, which indicates a much faster recovery. This disparity may reflect the cause of the crisis in these countries being excessive private, and not public, borrowing. Before the crisis both countries received a triple-A rating from the two measures, which is consistent with the previous findings that the public finances were not a potential problem. It is only when the two governments started to bail out their private banks that the historic ratings were downgraded. Our measure, which focuses on the fiscal stance, suggests that the underlying position is stronger than the official ratings allow.

Credit downgrades are feared by governments because markets are more reluctant to hold their debt which causes a fall in bond prices, implying a much higher interest rate on new issues or for rolling over debt. The case of the UK is of interest. Although not in EMU, and so not directly affected by the eurozone crisis, throughout the financial crisis the UK received a triple-A official rating. It was only in February 2013 that the UK was downgraded one notch by Moody's and later by Fitch, in April 2013. Compared with our measure this response to

the crisis appears to be too late. Moreover, by 2012, the UK appears to have recovered its triple-A rating. Further evidence of the mis-timing of the official UK credit rating is given by the spread between Libor and the overnight swap rate (OIS). This is shown in Figure 11. Although markets did not anticipate the crisis, they clearly responded much earlier than the credit rating agencies, and they reduced the spread much earlier. The correspondence between our measure of the UK's credit rating and this spread suggests that model-based sovereign credit ratings can provide a timely warning and indicate when changes in interest rates are warranted. We have obtained similar findings for the United States (Polito and Wickens, 2012b) based on comparing our measure of the US credit rating with credit default swap data.

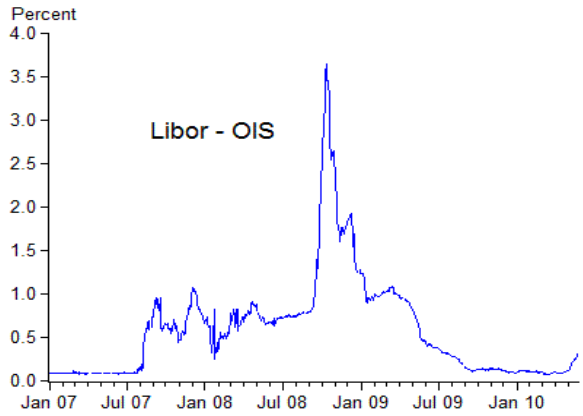


Figure 11. The spread between LIBOR and UK overnight swap rates

We have suggested that markets might be able to offset a monetary policy set for the whole eurozone that is inappropriate for some eurozone countries by adjusting the rates at which these particular countries can borrow from the market. Our analysis in this section suggests that this did not happen prior to the eurozone crisis but, once the crisis occurred, markets did raise rates sharply for the crisis countries; they were back to levels observed prior to the start of EMU. Further, official credit ratings did not reflect the risk inherent in the fiscal stances of the crisis countries, or did so too slowly. Therefore, while markets could, in principle, offset the one-size-fits-all monetary policy of the eurozone, the evidence suggests that, in practice, they failed to do so.

# 5 Conclusions

The attention of policymakers has turned to how to deal with the eurozone crisis. Their recommendation is to make drastic changes to the eurozone by creating a fiscal union, a banking union and a political union. In this paper we seek to understand how the crisis occurred, and what might be done to avoid

similar mistakes in the future, rather than how to clear up after the crisis. In this way it might be possible to avoid making such drastic treaty changes.

Our contention, supported by the evidence we present, is that the underlying cause of the crisis was that monetary policy was too loose in the crisis countries (Greece, Ireland, Italy, Portugal and Spain). Unlike the financial crises in the United States, the United Kingdom, and even Germany and Switzerland, the eurozone crisis was not due the U.S. sub-prime crisis. The reason monetary policy was too loose in the crisis countries was that the one-size-fits-all monetary policy set by the ECB is based on the eurozone's rate of inflation which is dominated by the rates of inflation of the core countries: Germany, France and the Netherlands. Given its mandate, there is nothing that the ECB can do about this. The crisis countries entered the euro with higher inflation rates than the core countries and, rather than converge to the average eurozone inflation rate, until the crisis, they remained higher. This was because the common interest rate produced a negative real rate in the crisis countries which stimulated excessive private or public borrowing, causing high GDP growth rates and thereby maintaining initial inflation differentials and a loss of competitiveness.

We suggest that there are two possible ways to avoid this intrinsic consequence of having a single currency for independent countries, and hence the need to rewrite eurozone treaties. First, national fiscal policy can be used to offset an inappropriate monetary policy. For countries with higher than average inflation, this implies having a tighter than average fiscal stance. Note that simply aiming to stay within the same (3% of GDP) fiscal deficit limit as other countries - as has been proposed by the European Commission - may not deliver a tight enough fiscal stance if inflation is high. In effect, this implies that, having given up one policy instrument (monetary policy), a country then has to commit its other policy instrument (fiscal policy) in order to unravel the harmful consequences of receiving in return an inappropriate monetary policy. The main gain for this policy bargain is a fixed nominal exchange rate but, as we have seen, not a fixed real exchange rate. The evidence we have presented both on the fiscal stance and on credit ratings indicates that fiscal policy was not used prior to the eurozone crisis to offset an inappropriate monetary policy, hence the crisis. Nonetheless, it remains a potential solution for the future.

The second possible solution doesn't require any policy intervention. It is based on markets adjusting interest rates to offset low official rates by pricing in sovereign risk. This is what happened after the crisis. The crisis countries have been forced to borrow at much higher rates than before the crisis, rates that are closer to those they faced prior to entering the euro. The evidence, both on borrowing rates and official sovereign credit ratings, prior to the crisis shows that markets did not anticipate the crisis. A possible reason for this is that traditionally bond prices have primarily reflected price risk rather than default risk. Once the crisis hit, interest rate spreads immediately reflected this. What is needed is that bond prices better anticipate potential default. We have suggested that a possible way to achieve this is via a model-based assessment of sovereign credit ratings based on forecasts of fiscal fundamentals. The findings are encouraging. Our measure of sovereign credit ratings differs from official

ratings mainly for the crisis countries by better anticipating credit downgrades before the crisis, and upgrades afterwards. This indicates that, although they did not do so before, it might be possible for markets to provide a solution to the inherent problems of a single currency by the better pricing of bonds through taking sovereign default into account, and assessing this from fiscal fundamentals.

Finally, although not discussed in this paper explicitly, we note another way that markets can help offset monetary policy. We have remarked that the loss of competitiveness that resulted from the price level increases of the crisis countries caused a real exchange rate appreciation and current account deficits. In the absence of nominal exchange rate adjustment, regaining competitiveness would require costs to be kept under control. This entails having competitive labour markets and strong productivity growth which are also market solutions.

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